CONTRIBUTION TO THE ANATOMY OF THE ILYSIIDÆ.

BY JOSEPH C. THOMPSON, SURGEON, U. S. N.

Three species of this family have recently been the subjects of an autopsy. A few additional secondary characters have been learned, but none were of the primary importance of those already known, and which have been employed by Mr. Boulenger to maintain the group as a family.

The salient character found to be common to the three species studied, was the comparatively large diameter of the segment of the posterior vena cava that is just caudad to the heart. A generic character of rather an unusual nature was found in *Cylindrophis*, consisting of a bridge of connective tissue in the floor of the mouth, that extends between the sheath of the tongue and the lip.

Ilysia scytale (Linnæus).

This species has been made the subject of several pages by Dr. Beddard.[1] The characters of an example just studied conform with those touched on in the article, with the exception of the position of the liver. By Dr. Beddard, this organ was found to commence "just at the heart as in Vipers." In the present example the anterior tip of the liver was 37 mm. posterior to the apex of the heart.

A comparison of the measurements brings out the point that the only difference between the two specimens is in the position of the liver.

Specimen.—

	Collection of Dr. Beddard. Male.		Brit. Museum Exchange Series. Female.	
Sex.	mm.	Per cent.	mm.	Per cent.
Total length	495	100	480	100
Apex of heart	115	23.2	125	26
Liver, anterior tip	115	23.2	162	33.7
Liver, posterior end	293	59	295	61.5
Gall-bladder	356	71.8	345	72
Kidney, right:				
Length	23		20	
Distance from cloaca	21		30	
Kidney, left:				
Length	21		15	
Distance from cloaca	11		21	

[1] *Proc. Zool. Soc. London*, 1906, vol. I, p. 31.

Specimen.—Brit. Mus. Ex. No. 19a. South America. Female: total length 480, tail 20 mm.

Squamation.—The number of scale rows, the sequence in which they are added, suppressed, and the gastrostege level at which these changes occur, are as follows:

19 rows, VI row added, right 55th, left 53d gastrostege, making:
21 rows, V row ends, right 206th, left 202d gastrostege, leaving:
19 rows, VI row ends, right 220th, left 221st gastrostege, leaving:
17 rows, which are continued to the vent.

Gastrosteges 236; anal divided; urosteges 12 and a terminal scute, the first and second paired, the remainder entire. Frontal barely touching the occipital; supraocular larger than the parietal; supralabials 5, the third and fourth touching the ocular shield; infralabials 5, the first pair the deepest and in contact behind the long mental; a single pair of large geneials which are not in contact; three azygos gular shields.

Anatomy.—The *tracheal cartilages* terminate at the level of the 61st gastrostege. The *tracheal membrane* is narrow and is not lined with pulmonary tissue. The *right lung* extends from the 57th to the 135th gastrostege; it is 152 mm. long, and lined throughout with pulmonary tissue. There is a small free apex, 2.5 mm. long, that extends to the 57th gastrostege; it is in relation with the right side of the trachea, and the lumen is continuous with that of the lung. The lung terminates in a blunt end which is 3.3 mm. in diameter. The *left lung*, 5.5 mm. long, extends from the 58th to the 61st gastrostege. It is in relation above with the end of the trachea and the right lung, to the right with the apex of the heart and the inferior vena cava, below with the ventral wall of the pleural cavity, and to the left with the stomach. It is lined with pulmonary tissue throughout. The *left bronchus* opens from the ventral side of the trachea opposite the 60th gastrostege. It enters the lung at the junction of the middle and the posterior one-third. The *liver* in this species and in *Cylindrophis rufus* is peculiar in that macroscopically it appears finely reticulate, with lines composed of minute black dots.

The anterior portion of the liver from the tip to the level of the 126th gastrostege is composed of the left lobe, along the right side of which courses the large inferior vena cava. At the 126th gastrostege this vessel begins to furrow the ventral and left side of the liver and divides the organ into right and left lobes. These lobes continue posteriorly; the right, which is 6 mm. the longer, terminating at the 147th, and the left at the 144th gastrostege.

The coiled portion of the *ileum* terminates at the 209th gastrostege; the remainder, 9 mm. in length, is straight.

The *ileo-cæcal valve* is at the 214th gastrostege.

The *cæcal pouch*, 8.5 mm. long, extends from the 214th to the 209th gastrostege; it lies between the right oviduct and the terminal straight portion of the ileum.

The junction of the ileum and cæcum, and the cæcal pouch are subject to a wide range of variation in different species, and are worthy of being recorded in detail.

The *posterior vena cava* is anomalous owing to its large diameter, which is 2.5 mm. Upon opening the cœlum, just caudad to the heart, this vessel appears as if it were the liver. The illusion is increased as just posterior to the apex of the heart this vein is sharply flexed towards the dorsal wall, and from below, this bend looks exactly like the blunt tip of a liver.

The *external landmarks* of the principal viscera in terms of gastrosteges are as follows:

		Per cent.
Total number of gastrosteges	236	100
Apex of heart	59	25
Liver, anterior tip	78	33
Liver, posterior end	147	62.2
Gall-bladder, centre	171	72.5
Kidney, right, anterior tip	210	88.8
Kidney, right, posterior end	220	93
Kidney, left, anterior tip	216	91.5
Kidney, left, posterior end	226	95.8

The scale formula in this specimen is abnormal. It will be noted that the first row to be added was the VI, and the first to be suppressed was the V, and the next to be dropped was the VI. The normal condition would have been for the VI to be the first suppressed followed by the V.

Over five hundred specimens of various species have recently been investigated for this scale formula character. In the normal state, when a certain scale row is added anteriorly and further along the body begins to taper and a reduced count occurs, this reduced count is regularly brought about by the suppression posteriorly of the same scale row that was added. Where several rows are added and later these are suppressed, the sequence of suppression is regularly in an inverse order to that in which they appeared.

The scale formula of a different specimen having 226 gastrosteges was as follows:

19 rows, VI added, right 52d, left 52d gastrostege, making:
21 rows, VI ends, right 199th, left 194th gastrostege, leaving:
19 rows, which are continuous to the vent.

CYLINDROPHIS Wagler.

Since the publication of the *Catalogue of the Snakes in the British Museum*, there have been described two new[2] species belonging to the Ilysiidæ. Both of these new forms are in the genus *Cylindrophis*, the species of which may be distinguished as follows:

I—Diameter of the eye about half its distance from the nostril.
Interocular width more than the length of the snout ..... *rufus.*
Interocular width equal to the length of the snout ..... *isolepis.*
II—Diameter of the eye one-third to one-fourth its distance from the nostril.
A—Ventrals not twice as large as the contiguous scales.
Scales in 23 rows ..... *opisthorhodus.*
Scales in 21 to 19 rows ..... *maculatus.*
B—Ventrals nearly twice as large as the contiguous scales.
Scales in 21 rows ..... *lineatus.*

Cylindrophis rufus (Laurenti).

Specimen.—California Acad. Sci., No. 33,054. Sarawak, Borneo. Male; total length 454, tail 11 mm.

Squamation.—The number of scale-rows on the body, the sequence in which they become suppressed, and the gastrostege level at which they terminate are as follows:

Neck:
21 rows, IV row ends, right 8th, left 8th gastrostege, leaving:
Body:
19 rows, V row ends, right 195th, left 190th gastrostege, leaving:
17 rows, which are continued to the vent.

Gastrosteges 202; anal divided; urosteges 6, second and fourth divided, the remainder entire. Præfrontal enters the eye; frontal larger than the supraocular, larger than the parietal, longer than its distance from the rostral; a small postocular; supralabials 6, the third and fourth entering the eye; infralabials 6; a single pair of geneials; one pair and two azygos gular shields.

Anatomy.—The *tracheal membrane* is narrow and is not lined with pulmonary tissue. The *trachea* terminates just caudad to the left bronchus. The right *intrapulmonary bronchus* terminates at the 61st gastrostege. It appears as the narrowed continuation of the

[2] *Cylindrophis isolepis* Boulenger, 1896, *Ann. Mag. Nat. Hist.*, (6), vol. XVIII, p. 62, Jampea, Id.
C. opisthorhodus Boulenger, 1897, *loc. cit.*, vol. XIX, p. 506, Lombok.

trachea. At first it is a gutter of bronchial tissue, from the edges of which the ends of the cartilages project into the lumen of the lung for a distance of .3 mm.

The right lung extends from the 54th to the 114th gastrostege. It is lined with pulmonary tissue to about the 100th gastrostege; the terminal portion ends as a blunt and stout-walled anangious air-sac. There is an *apex*, 2.5 mm. long, and adherent to the right side of the trachea. The wall between the apex and the trachea is formed of pulmonary tissue alone, there being no fibrous tissue dividing the two structures. The lumen of the apex opens into the lung by a simple tube that is pentagonal in shape and appears to be a single air-cell that is deeper than the rest.

The *left lung*, 6 mm. long, is lined with air-cells. The bronchus, at the level of the 58th gastrostege, is a minute opening from the ventral wall of the trachea.

The left lobe of the *liver* extends from the 73d to the 111th gastrostege. At this point the posterior vena cavæ begins to furrow the organ and to form the right lobe. Posteriorly the two lobes end nearly at the same level, the right being but 1.5 mm. the longer.

The *gall-bladder* is 6 mm. long. The *cystic duct* flows forward for 1.5 mm., and is composed of several tubes. The *hepatic duct* divides into several branches; these anastomose with the cystic duct to form a complex rete which is 7 mm. long and flows anteriorly to enter the pancreas. The usual condition in serpents is for the hepatic and cystic ducts to join posteriorly to the gall-bladder.

The *ileum* is lined with fine longitudinal folds. The last loop is at the 172d gastrostege; from this point it is nearly straight. At the 176th gastrostege there is a sacculated dilatation 3 mm. long and about one-half again the diameter of the gut. The walls are thin and pellucid and the lining is smooth.

The *cæcum* is lined with deep longitudinal plicæ and there are no transverse septal folds. The *ileo-cæcal* valve is at the 193d gastrostege. The cæcal pouch is small, being 2.5 mm. long and of about the same diameter; it lies dorsad to the ileum.

The *intercostal arteries* are regular, being one for each space. Each arises as a single artery that bifucates below the median line, one fork entering on either side.

The *teeth* are of moderate size; the *maxillary* bears 11, the palatine 6, the pterygoid 5, and the dentary bone 12 teeth.

The *floor of the mouth* presents unusual conditions. The mandible bends towards the median line, and the anterior tip of the dentary

bone protrudes through the floor of the mouth for a distance of 1 mm. The tip is covered with pad of fibrous tissue and the mucous membrane. The opening of the sheath of the tongue is 3 mm. from the lip. A tough band of fibrous tissue, which is furrowed above for the tongue, extends between this opening and the lip. This band is attached anteriorly and posteriorly; beneath it is free and forms a bridge under which an instrument may be passed. Between the anterior attachment of this bridge and the tip of each dentary bone, is an opening into a pouch which lies on either side of the median line. Each pouch is covered above by the mucous membrane of the mouth, and extends posteriorly to the level of the opening of the sheath of the tongue. These pouches are in communication with each other beneath the bridge of connective tissue that extends from the opening of the sheath of the tongue to the lip.

The *external landmarks* of the principal viscera in terms of gastrosteges are as follows:

		Per cent.
Total number of gastrosteges	202	100
Apex of heart	58	28.7
Liver, anterior tip	73	36.2
Liver, posterior end	128	63.5
Gall-bladder, centre	138	68.5
Testis, right, anterior tip	150	74.4
Testis, right, posterior end	155	77.1
Testis, left, anterior tip	162	80.2
Testis, left, posterior end	167	82.8
Kidney, right, anterior tip	172	85
Kidney, right, posterior end	186	92
Kidney, left, anterior tip	176	87
Kidney, left, posterior end	190	94

In this species it will be noted that the scale-row count of 21 terminates well forward on the neck, and that the count of 19 persists nearly to the vent.

A uniform scale-row count over the entire body is found in two types of serpents. It occurs in those with cylindrical bodies in which there is no reduction of the diameter posteriorly and also in those in which the body tapers posteriorly. The majority of those in the latter category are in widely separated genera belonging to the Colubridæ. These genera with tapering bodies have one character in common and that is the scale-row count is regularly a low one, being usually 17, 15, or 13 rows throughout. In these serpents the scales accommodate themselves to the narrowing of the body by becoming smaller.

In the majority of species the tapering of the body is associated

with a reduced scale count posteriorly. In each species this reduced scale count is brought about by the loss of definite scale rows. The discovery of this phenomenon was made by Mr. Ruthven while studying the genus *Thamnophis*.[3]

Two additional characters bearing on this subject may be entered into. If a series of one species is critically recorded, it will be found that not only is there a definite sequence of suppression, but that a given scale row terminates at about the same relative position on the spinal column in each specimen. Also, that the suppression of a scale row is in fairly definite relation to the posterior end of an underlying organ.

It is to be understood that these two characters are stated in general terms. Barring individual variation, for which no allowance can be made, they will be found to hold with satisfactory constancy.

Bibliography.—The original description of this species is contained on page 71 of the *Synopsin Reptilium* by Laurenti, published in 1768. In this work the serpent was named *Anguis ruffa*. Throughout literature it has been referred to by the emended name of *rufa*. It is probably only a question of time before some philologist will insist that the current term be again emended and that the original incongruous spelling be perpetuated.

Cylindrophis maculatus (Linnæus).

Specimen.—California Acad. Sci., No. 16,890. Ceylon.

Female; total length 330, tail 6.5 mm.

Squamation.—The number of scale rows, the sequence in which they are added or suppressed, and the gastrostege level at which these changes occur may be thus presented:

Neck:
19 rows, V row ends, right 10th, left 8th gastrostege, leaving:

Body:
17 rows, IV row added, right 39th, left 49th gastrostege, making:
19 rows, IV row ends, right 182d, left 184th gastrostege, leaving:
17 rows, which are continued to the vent.

Gastrosteges 194, in the middle of the body 3 mm. wide, adjacent scale row 2.5 mm. wide; anal divided, urosteges 5, entire. Præfrontal the largest shield; one small postocular; supralabials 6, the third and the fourth entering the eye; infralabials 6; anterior geneials large; one pair and two azygos gular shields.

Anatomy.—The *tracheal membrane* is narrow and is not lined with

[3] 1908, *Bull. 61, U. S. National Museum.*

air-cells. The *right lung* extends from the 58th to the 98th gastrostege and is lined throughout with respiratory tissue. The *apex* is adherent at the trachea. The *left lung* is 5 mm. long and contains air-cells; anteriorly it is narrow and posteriorly broad and truncate. The left bronchus is at the 60th gastrostege and enters at the middle of the lung.

The *liver* begins at the 78th gastrostege. At the 91st gastrostege there is an S-shaped kink in the organ, the recurrent limb of which is 6 mm. long, and lies to the right and above the anterior portion. The liver reaches to the 113th gastrostege; at this point the end bends downward and forward for a distance of 3 mm. Whatever may have been the cause of the kink in the liver, it apparently in no way affected the right lung. The liver from the anterior tip to the first bend in the kink lies to the left and below the lung; the recurrent limb of the kink is ventrad to the lung; the liver posterior to the second bend in the kink lies to the right and below the lung. In other words, the lung is perfectly straight and lies at first to the right side, then above the kink, and finally to the left side of the liver. A similar flexure of the liver has been observed in a female *Tropidonotus vibakari* Boie, containing embryos that were nearly mature.

The *œsophagus* at the 96th gastrostege makes a Z-shaped bend; the recurrent limb of which is 4 m. long, and is directed forwards and to the left. This bend is in the horizontal plane and is just caudad to the S-shaped kink in the liver.

The *posterior vena cava* is of large calibre; it has two kinks, one just caudad to the left lung, and the other 8 mm. anterior to the tip of the liver.

Whether these kinks in the various organs are deformities or are part of the displacement of the viscera during the latter weeks of pregnancy is not certain.

The *ileo-cæcal* valve is at the 182d gastrostege. The *cæcal pouch* is 6 mm. long and the apex is at the 177th gastrostege. It is of the same diameter as the cæcum and lies between the ileum and the right ovary.

The *teeth* are less in number than in *C. rufus*. The *maxillary* bears 8, the palatine 7, the pterygoid 4, and the dentary bone 11 teeth.

The *floor of the mouth* has the protruding tips of the maxillary bones and the two pouches on either side of the median line quite as described in *C. rufus*.

There are three *embryos;* these extend from the 118th to the 178th gastrostege. The growth of the anterior one has been aborted, evidently owing to pressure. The middle one has a yolk sac 25 mm. long, on the dorsal and anterior surface of which is coiled the embryo. The head is free, being beneath and anterior to the coils. The prevailing condition is for the head to be in the centre of the coils, where it is more protected. The total length of the embryo, when uncoiled, is about 45 mm. The tail measures 2 mm., which is longer proportionately than in the adult. Each rudimentary hind limb is free; it is held at right angles to the body and measures .5 mm. in length. The yolk sac of the posterior embryo measures 36 mm.

A well-nourished *fat-body* lies between the bend in the œsophagus and the first embryo.

The *external landmarks* of the principal viscera in terms of gastrosteges are as follows:

		Per cent.
Total number of gastrosteges	194	100
Apex of heart	60	30.9
Liver, anterior tip	78	40.2
Liver, posterior end	113	58.2
Gall-bladder, centre	116	59.8
Kidney, right, anterior tip	172	88.7
Kidney, right, posterior end	181	93.1
Kidney, left, anterior tip	178	90.8
Kidney, left, posterior end	185	95.2

In these three species a comparison of the position of the viscera in terms of percentage down the spinal column may be presented:

Species.—

Sex.	*Ilysia scytale.* Female.	*Cylindrophis rufus.* Male.	*Cylindrophis maculatus.* Female.
Spinal column	100	100	100
Apex of heart	25	29	31
Liver, anterior tip	33	36	40
Liver, posterior end	62	63	58
Gall-bladder	72	68	60
Kidney, right, tip	89	85	89
Kidney, right, end	93	92	93
Kidney, left, tip	91	87	91
Kidney, left, end	96	94	95

To obtain this data the number of the gastrostege underlying a given anatomical point, counting from the first shield in the neck, is noted. This number is then divided by the total number of gastrosteges in the specimen, thereby giving the position in terms of percentage.